



# UPDATE

**Disease  
Non-battle  
Injury  
in the Korean  
Theater**

No. 4; Vol. 1  
April 2002

*A Publication of the 18<sup>th</sup> MEDCOM Preventive Services Directorate*  
*"Preserving the Fighting Strength"*

## INTRODUCTION

This month's focus is on preventing, diagnosing and treating malaria and heat injuries. Both heat injuries and malaria can masquerade as many other illnesses, such as gastrointestinal illness or viral syndromes, which can delay definitive treatment. Increased provider awareness, and soldier education regarding prevention are the major keys in reducing morbidity from these conditions.

## MALARIA

Now that spring and warmer temperatures have arrived, so have the mosquitoes and concern for malaria. In 1979, after much dedicated work, the Republic of Korea (ROK) was declared malaria-free by the World Health Organization (WHO). In 1993 the disease reemerged along the Demilitarized Zone (DMZ), provoking fear and concern in personnel stationed in that area. The resurgence was hypothesized to have originated from the reintroduction of infected mosquitos along the DMZ.

There are four species of malaria. It is important to understand that the malaria present in the Republic of Korea is caused by *Plasmodium vivax*. This species causes a febrile illness characterized by high fevers, shaking chills, myalgia, headache and often diarrhea. While impressive, this form is rarely fatal. Approximately 10% of patients may experience recurrent disease which is usually cured by a second course of chloroquine and primaquin. While a problem in other areas, chloroquine resistance is not seen here.

Korean vivax malaria is somewhat unique in its incubation period. Approximately 50% of patients will develop disease within 2-3 weeks of a bite by an infected mosquito. The remainder, however, demonstrate a much longer incubation period—as long as 5-9 months after infection, or in some extreme instances, as long as 12-18 months after infection.

While many people think of medicinal prophylaxis for preventing malaria, it can often serve to merely delay the onset of symptoms. In truth, avoiding mosquito bites is the best defense against this disease. Experimental studies demonstrate **99.94%** reduction in bites can be achieved by applying DEET to exposed skin and wearing a permethrin-treated uniform with sleeves down and pant legs tucked into the boots (see Table 1).

The most effective DEET repellent is the military formula (NSN 6840-01-284-3982). The polymer creme with 33% DEET content is easy to apply and longer-lasting than commercial forms. However, if this is unavailable, commercial versions containing 20-30% DEET are acceptable. Use of 100% DEET formulations is discouraged, as it increases chemical exposure and is actually less effective over time.

## DNBI UPDATE

A Publication of the 18<sup>th</sup> MEDCOM Preventive Services Directorate

"Preserving the Fighting Strength"

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*Views and opinions expressed are not necessarily those of the 18<sup>th</sup> MEDCOM or the Department of the Army.*

Personal Protective Measures	# Bites/8-9 hr day	% Reduction	% Total Bites on Exposed Skin	% bites through Uniform
Untreated Uniform No DEET on skin	2287	N/A	83	17
Untreated Uniform DEET on Skin	99	96	12	88
Treated Uniform No DEET on Skin	54	98	99.99	0.01
Treated Uniform; DEET on Skin	2	99.94	100	0

Table 1: Reduction in mosquito bites with proper wear of the uniform and using the military DEET formula.

## US Experience

Figure I depicts the number of cases of malaria seen in US soldiers exposed to malaria while stationed in Korea. Malaria appeared to peak during 1998 and 1999 and has declined each year since. All cases in 2001 were contracted from exposure to mosquitoes at training sites in Area I, and are most commonly attributed to exposure during training exercises. The 2002 USFK Malaria Prevention Plan recommends strict adherence to Personal Protective Measures (PPM) for units stationed or training near the DMZ. These measures include the use of permethrin-treated uniforms, appropriate DEET application to exposed skin, as well as the use of permethrin-treated bednets. Chemoprophylaxis is not recommended this year, but is available to units stationed in the DMZ requesting it.

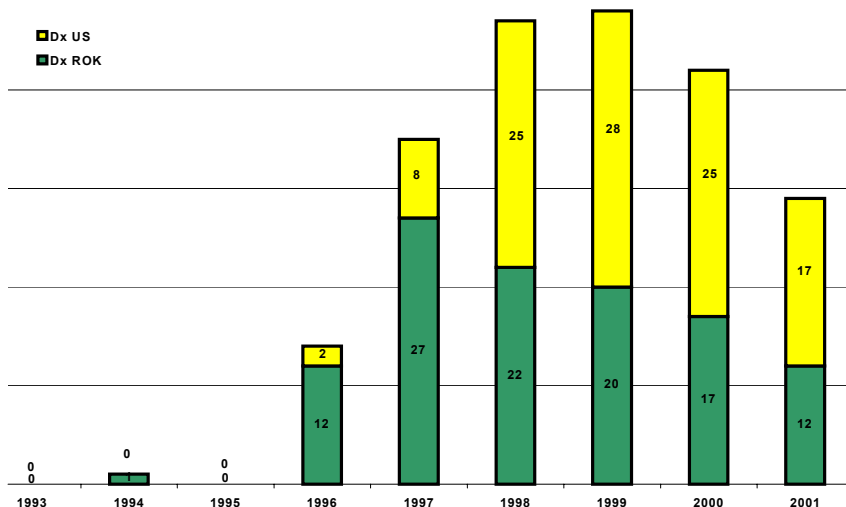


Figure I: Malaria incidence in US troops stationed in Korea 1993-2001. Personnel were diagnosed with malaria while in Korea, or were diagnosed with malaria in after return to US, but illness was attributed to exposure in Korea (consistent with delayed-onset malaria).

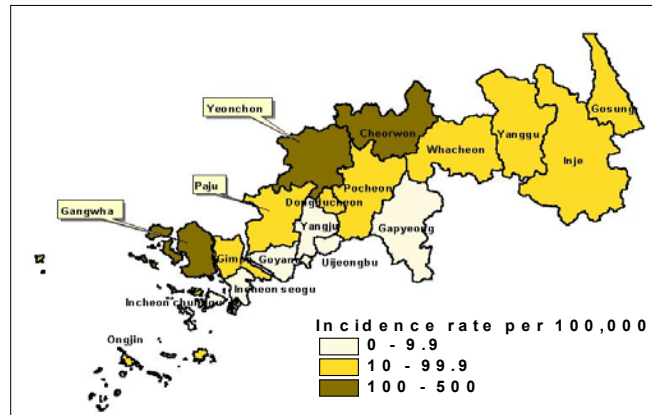
## Korean Experience

The Korean experience with malaria during this same time is very similar to ours, in both civilian and military populations. Figure 2 shows the counties along the DMZ that were most affected with malaria in 2001.

Figure 2: Prevalence of malaria by county in ROK military and civilian populations near the DMZ.

The darkest areas have the highest number of reported cases per 100,000 population.

Figure provided by the Korea National Institute of Health.



## Diagnosing Malaria

Being aware of malaria is the first step in diagnosing it. Malaria commonly mimics viral syndromes and gastroenteritis, and should be considered in febrile patients, particularly those who present with high fever ( $>102^{\circ}\text{F}$ ), chills, myalgias and headache. Diarrhea is common, although cough, nausea and vomiting are not common presenting symptoms. Between fevers, the patient usually feels much better—practically well, except for some fatigue.

After consultation with the on-call providers, patients suspected of having malaria should be sent to the 121 for evaluation. The diagnosis is only confirmed with a positive blood smear, which is best performed at the Seoul Army Community Hospital. Infected red blood cells (RBCs), being heavier than normal RBCs, tend to cling to the glass tube surface when slide preparation is delayed. Smears are best obtained during a febrile episode, and should be repeated every 8-12 hours over 2-3 days before ruling out malaria, as a low parasitemia may not be evident on the initial smear. While patients with malaria may be treated as outpatients, overnight admission is preferred, in order to complete an epidemiological investigation and to prevent transmission of malaria parasites to mosquitos, thus breaking the vector-host-disease cycle.

The 18<sup>th</sup> MEDCOM Preventive Medicine Consultant should be contacted for any questions regarding suspected or confirmed malaria, malaria prophylaxis or malaria treatment. All cases should be reported via the 18<sup>th</sup> MEDCOM Reportable Events Worksheet. The form is available at <https://www.seoul.amedd.army.mil/Pm/Forms/Reportdisform18medFebo2.pdf>. The 18<sup>th</sup> MEDCOM Preventive Services Directorate is actively trapping mosquitoes and assaying for malaria, in addition to supporting for vector control measures in higher-risk areas.

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### Resources:

18<sup>th</sup> MEDCOM PSD Malaria Databank

2002 USFK Malaria Prevention Plan.

Chai, J.Y. (1999). Re-emerging *Plasmodium vivax* malaria in the Republic of Korea. *The Korean Journal of Parasitology*. Vol. 37, No. 3, 129-143.

Korean Ministry of Health

*Health Effects of Permethrin-Impregnated Army Battle-Dress Uniforms*, National Academy Press, 1994.

## Heat Injuries

Heat injuries are an all-too common and preventable occurrence among service members. 462 heat injuries were reported Army-wide for 2001; only 4 were reported in 18<sup>th</sup> MEDCOM

### **KEY POINTS IN HEAT INJURY PREVENTION**

- + Successful prevention of heat casualties is more important to the unit than their treatment.
- + Your success in preventing heat illnesses will depend on your skill as an educator and trainer.
- + To influence the conduct of an operation or training you must integrate yourself into the planning process.
- + Be alert to early signs of dehydration and heat illness. They forewarn of more severe casualties to come without intervention.
- + Be sure there will be enough water when and where you need it. Never forego water planning!!
- + The skin is a vital organ in the heat. Its care is more than just for comfort or aesthetics.
- + Reducing heat load reduces water requirements. Use shade and night as much as possible.

beneficiaries. While these numbers appear to contradict the opening sentence, in reality these numbers most likely reflect deficiencies in the reporting system. In the past, heat injury reporting has been associated with command liability. Current uses of heat injury reporting emphasize improved training and activity planning with emphasis on prevention to preserve the fighting strength.

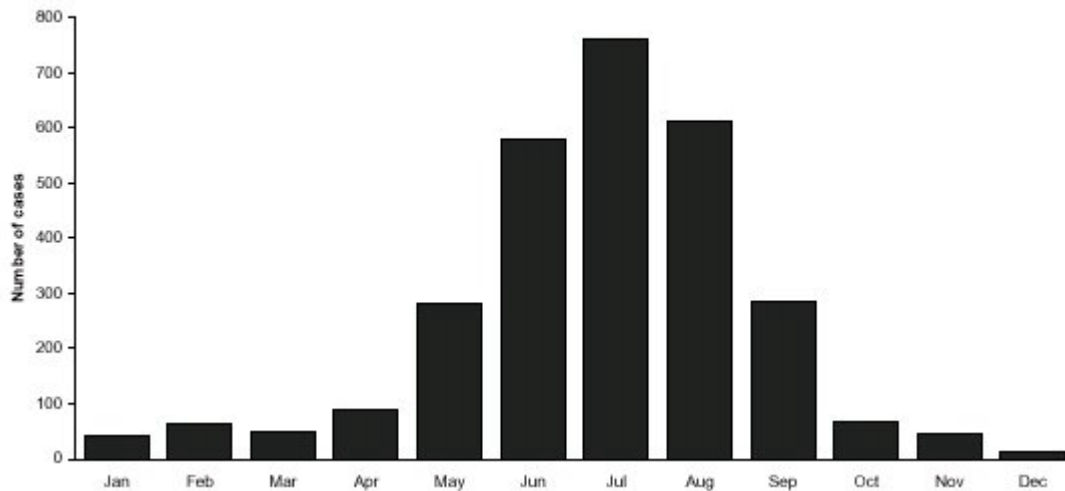
The recent popularity of ephedra- and caffeine-containing supplements among service members brings new complications to the heat injury scenario. Easily available on AAFES shelves, manufacturers entice the unsuspecting through claims of enhanced performance, greater energy, and heightened metabolism and rapid weight loss. Approximately 45% of service members use such

supplements, and at least two deaths among active duty soldiers at other installations have been attributed to their use. Of note, Health Canada issued a voluntary recall of all ephedra/ephedrine-containing products after a risk assessment found these products posing serious health risks. In the United States, these products are not regulated by the Food and Drug Administration; consequently amount and purity of active-ingredient can vary significantly from pill to pill and between manufacturers.

### **Prevention**

Why prevent heat injury? Heat injury is not an inevitable consequence of military duty. It can cause long-term morbidity such as cognitive deficit and kidney failure. It can even kill. Use of ephedra- and/or caffeine-containing supplements further increases risk for heat injury by increasing heart rate, inhibiting ADH release, and constricting peripheral blood vessels. They also suppress appetite, and poor oral intake promotes heat injury, particularly in field settings. Higher doses can result in nausea and vomiting, seizure and serious arrhythmias, all of which overlap and complicate heat exposure syndromes.

Provider education is crucial for appropriate command prevention measures and for the early recognition and treatment of heat injuries. It is important to understand that while most heat casualties occur during the summer months, most of these occur under Heat Category I conditions, and not necessarily in the heat of the day. This is often because a person works in the heat one day, may not fully replenish fluids that evening, then gets up for PT without additional hydration. It is also important to be aware of the 'weak link' rule: The appearance of a heat injury in a unit suggests others are at risk, and that all unit members should be evaluated immediately.

**Figure 1. Number of heat injuries by month - US Army, 1998-2000**

## Recognizing and Treating Heat-Related Illnesses

Mild heat-related illnesses include milia rubra, sunburn, heat cramps, and heat syncope. The classic entities of heat exhaustion and heat stroke represent progressive points on the continuum of heat injury, and will be discussed together.

### **Miliaria Rubra**

Miliaria rubra refers to a subacute pruritic papulovesicular skin eruption which appears in actively sweating skin exposed to high humidity. Each papule represents a clogged sweat gland, thus limiting the body's cooling ability. Treatment involves cooling and drying affected areas, avoiding sweating, and relieving itching. Secondary infections should be treated with appropriate antibiotics. Sweat gland function will return with shedding of the affected epidermis, and usually takes about 7-10 days. A rare but disabling disorder is miliaria profunda. This is a generalized and prolonged form of miliaria which results in the absence of sweat production and leads to anhidrotic heat exhaustion or stroke, even in conditions easily tolerated by most people.

### **Sunburn**

Sunburn is mentioned here because the resulting skin damage degrades the body's ability to cool, thus predisposing victims to heat injuries. In addition, a sunburn may highlight a person with increased exposure, which also suggests increased risk of more serious heat injury.

### **Heat Cramps**

Heat cramps are painful tonic contractions of skeletal muscles, usually with visible fasciculations, that occur as a result of whole-body salt loss. Cardiac and smooth muscles are not involved. The symptoms may occur during activity or many hours later. Entities to first rule out include tetany due to alkalosis (can be seen in hyperventilation, severe gastroenteritis, even cholera) or hypocalcemia, strychnine poisoning, black widow spider envenomation or abdominal colic. These should be distinguishable on clinical examination.

Treatment involves salt replacement, which can provide dramatic relief--enough to confirm the diagnosis. The route of administration is determined by symptom severity. However, oral replacement should be limited to no more than a 0.1% salt solution (i.e., do NOT use salt tablets). Care must be taken to avoid hypernatremia.

While this is a painful and impressive condition, an episode of heat cramps does not imply the patient has an increased susceptibility to heat injury. Such an episode does, however, suggest a substantial water and salt deficit (15-30 grams or 2-3 day usual intake). Therefore, patients must be allowed at least 72hrs recovery to replace the deficit. Short-term complications are limited to muscle soreness. No long-term sequelae are known.

**Heat Syncope**

Syncope occurring on standing in a hot environment has been called "heat syncope". Heat syncope is probably not a discrete clinical entity. Rather, thermal stress increases the risk of classic neurally-mediated (vasovagal) syncope by aggravating peripheral pooling of blood in dilated cutaneous vessels. No special heat-related significance should be assigned to syncope occurring in these circumstances. Clinical evaluation and management should be directed toward the syncopal episode, not potential heat illness. However, syncope occurring during or after work in the heat or after more than 5 days of heat exposure should be considered evidence of heat exhaustion.

**Heat Exhaustion and Heat Stroke**

Heat exhaustion and heat stroke are differentiated primarily by the absence or presence of tissue damage. Therefore, at presentation, the distinction between heat exhaustion and heat stroke, in all but the most extreme cases, is impossible.

Presenting symptoms are non-specific and can vary widely. Fatigue, nausea, vomiting, muscle cramps, hyperthermia, confusion, dizziness and headache are often seen. Thirst may or may not be present. Contributing conditions, such as gastroenteritis or other febrile illness, may also be present. Workup should include careful vital signs including orthostatic blood pressures and RECTAL temperature, CBC (including platelet count), serum electrolytes, BUN, creatinine, glucose and U/A. If heat stroke is suspected, FT, APTT, Fibrin split products or analog, liver enzymes, CK isoenzymes, LOG and CXR should be obtained as soon as possible. Other data are obtained as needed to complete the differential diagnosis of the presenting complaint. Rectal temperature should be frequently monitored to ensure that core temperature is falling to normothermic levels.

Heat exhaustion casualties retain the ability to cool spontaneously if removed from the stressful circumstances. However, spontaneous cooling is necessarily observed only AFTER cooling has occurred. Since casualties with heat stroke and heat exhaustion are hard to distinguish initially, medical personnel who elect to delay active cooling to see if a casualty can spontaneously cool, will occasionally fail to provide immediate active cooling for a casualty with heat stroke. The SAFEST COURSE is to provide active cooling for all casualties who are at risk for heat stroke. Cooling measures include removing clothing and applying cold packs to pressure points. The most effective method of rapid cooling is to cover the patient with a thin wet cotton bedsheet (not a blanket) and place a fan so that it blows over the person. Do not let the sheet dry. Lateral decubitus positioning, if not otherwise contraindicated, exposes maximal surface area, maximizing cooling. Hydration, whether IV or oral, is also cooling. However, be wary when considering the administration of more than 2L IVF. Hyponatremia can mimic heat injury. Individuals who do not respond dramatically to rest and fluid-electrolyte repletion in the BAS/UCC setting should be sent to the Seoul Army Community Hospital for evaluation and laboratory surveillance for the delayed complications of heat stroke. Since the renal and hepatic complications of heat stroke can be delayed for 48-72 hours, any evidence of renal or hepatic injury during the initial 24 hours of observation should lead to the presumptive diagnosis of heat stroke. Encephalopathy, coagulopathy or persistent elevation of body temperature also increase the probability of severe heat stroke. Immediate institution of active cooling and transport of such patients is required. Active cooling should be continued throughout the trip.

## Reporting and Profiling

All instances of heat exhaustion and heat stroke should be reported to the 18<sup>th</sup> MEDCOM Preventive Services Directorate. Information regarding extent of injury, patient activity leading to injury, weather conditions and medication/supplement use should be included. Report forms are available at <https://www.seoul.amedd.army.mil/Pm/Forms/Reportdisform18medFeb02.pdf>.

Temporary profiles allowing time for the soldier to recover from the heat-related illness is appropriate. However, a single episode of heat exhaustion does not imply any predisposition to heat injury. No permanent profile against heat exposure is required. An attempt should be made to determine the reason for the heat exhaustion. e.g., insufficient work-rest or water discipline, coincident illness or medication, etc. The individual should return to his unit with advice, both to the soldier and the chain-of-command, about how the incident happened and how to avoid similar episodes in the future.

Repeated episodes of heat injury, however, require thorough evaluation. Soldiers should not be returned to duty. They should be evacuated to a referral facility with a temporary profile against heat exposure. Sample profiles are available at <http://chppm-www.apgea.army.mil/heat/>.

## Resources:

<http://chppm-www.apgea.army.mil/heat/> contains links to training guides, medical care resources, and even **sample profiles** for environmental injuries!

Brundage, J.F. (March 2001). Heat Injuries—US Army, 1998-2000. MSMR, Vol 7, No. 3.

Heat Illness: A Handbook for Medical Officers, USARIEM Technical Note 91-3.

18<sup>th</sup> MEDCOM Preventive Services Staff offers heat injury training to area units!!

## Prevention Classes

**18<sup>th</sup> MEDCOM Area Community Health Nurses and Health Promotion Coordinators provide classes on a variety of topics, such as heat injury prevention, malaria education, STD prevention, weight loss, to name just a few. Please call for more information.**

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# ***DISEASE TRENDS***

18<sup>th</sup> MEDCOM Reportable Events Program

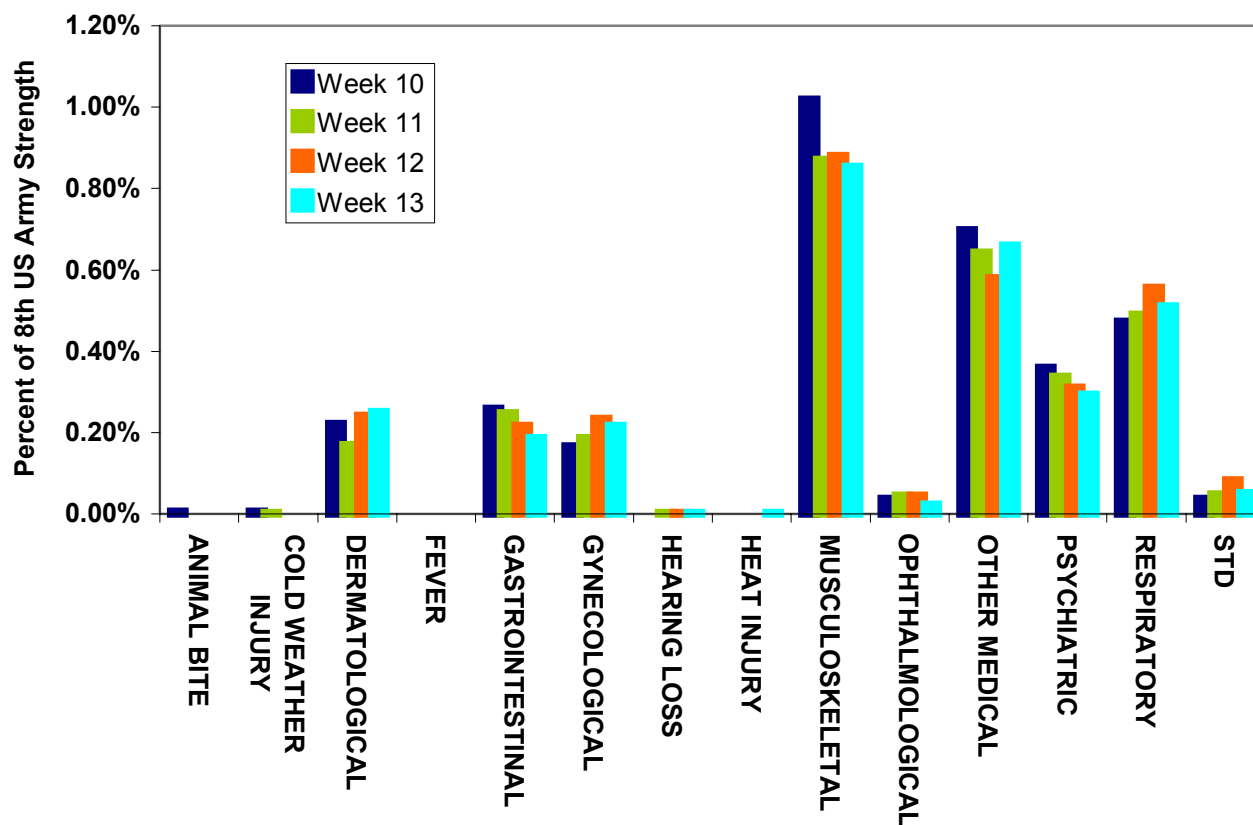
## **Selected Reportable Events Incidence Summary MAR 2002**

<b>Reportable Condition</b>	<b>Area I</b>	<b>Area II</b>	<b>Area III</b>	<b>Area IV</b>	<b>Totals</b>
Trichomonas	0	0	1	1	2
Chlamydia	6	11	15	7	39
Herpes simplex	NR	NR	NR	NR	NR
Gonorrhea	2	5	3	2	12
HIV	0	0	1	0	1
STD Totals	8	17	20	9	54
Tuberculosis (active disease)	0	0	1	0	1
Tuberculosis (recent converter)	10	8	3	2	23
Animal Bites	1	1	0	0	2
Cold Weather Injuries	1	NR	NR	NR	NR
Deaths from all causes	1	0	0	0	0

NR=None Reported



## Distribution of Disease Non-Battle Injury Medical Visits for Active Duty US Army Members Seen in 18<sup>th</sup> MEDCOM Clinics



**Editor's Note:** Data for above chart was generated through a manual review of KG-ADS diagnoses given each active duty US Army patient seen in 18<sup>th</sup> MEDCOM primary care, urgent care, and women's health clinics. Percentages are calculated based on total Army strength. Only one visit for the same disease or injury category was counted. Only KG-ADS data completed within a week or less of the patient visit was accessible. While DNBI tracking traditionally differentiates recreational injuries from training injuries and MVA injuries, the lack of information pertaining to cause of injury in KG-ADS makes this impossible to determine.

## Reported Events Summary, USFK: March 2002

	Conditions	Mar 2002	Cum 2002	Cum 2001
STD	Chlamydia	39	95	45
	Gonorrhea	12	27	26
	Herpes Type II	0	1	2
	HIV/AIDS	1	1	
	Trichomonas	2	5	
	Syphilis	0	0	1
Infectious Diseases	Campylobacter	0	0	
	Cholera	0	0	
	E.Coli 0157:H7	0	0	
	Encephalitis	0	0	
	Giardiasis	0	0	
	Hepatitis A	0	0	
	Hepatitis B	0	0	
	Hepatitis C	0	0	
	Influenza	0	0	
	Measles	0	0	
	Meningitis	0	0	1
	Pneumococcal Pneumonia	0	0	
	TB, Active	1	3	1
	PPD Conversion	23	51	19
	Salmonellosis	0	2	3
	Shigellosis	0	0	
	Typhoid Fever	0	0	
	Varicella, adult	0	1	2
Vector-borne Diseases	Dengue Fever	0	0	
	Ehrlichiosis	0	0	
	HFRS	0	0	
	Japanese Encephalitis	0	0	
	Leptospirosis	0	0	
	Malaria	0	1*	12^
	Rabies	0	0	
	Scrub Typhus	0	0	
Injuries	Animal Bites	1	7	17
	Cold Injury	1	2	
	Heat Injury	0	0	5
	CO Poisoning	0	0	
	Lead poisoning	0	0	
	Hearing Loss	0	0	
Immunization	VAERS	0	0	
	Influenza	0	0	

**Notes:**

\*Disease contracted outside ROK

^Indicates cases diagnosed while in ROK; additional 17 cases were diagnosed after return to US

Please refer to the reverse of the 18<sup>th</sup> MEDCOM IHO Reportable Events Worksheet for a complete listing of reportable events. A copy of this form is included at the end of this document.

# Heat Injury Prevention Chart

Fluid Replacement Guidelines for Warm Weather Training  
(Applies to average heat acclimated soldier wearing BDU, Hot Weather)

Heat Category	WBGT Index, °F	Easy Work		Moderate Work		Hard Work	
		Work/Rest	Water Intake, Qt/hr	Work/Rest	Water Intake, Qt/hr	Work/Rest	Water Intake, Qt/hr
1	78-81.9	NL	1/2	NL	3/4	40/20 min	3/4
2 (Green)	82-84.9	NL	1/2	50/10 min	3/4	30/30 min	1
3 (Yellow)	85-87.9	NL	3/4	40/20 min	3/4	30/30 min	1
4 (Red)	88-89.9	NL	3/4	30/30 min	3/4	20/40 min	1
5 (Black)	> 90	50/10 min	1	20/40 min	1	10/50 min	1

- The work rest times and fluid replacement volumes hydration volumes will sustain performance for at least 4 hours of work in the specified heat category. Individual water needs will vary approx ¼ qt or 8 ounces per hour.
- NL= no limit to work time per hour.
- Rest means minimal physical activity (sitting or standing), accomplished in shade if possible.
- CAUTION: Hourly fluid intake should not exceed 1<sup>1/2</sup> quarts.**
- Daily fluid intake should not exceed 12 quarts.**
- Wearing body armor adds 5 degrees Fahrenheit to WBGT Index
- Wearing MOPP overgarment add 10 degrees Fahrenheit to WBGT Index.

## Examples of Work Load Categories:

Easy Work	Moderate Work	Hard Work
<ul style="list-style-type: none"> <li>Walking hard surface at 2.5 mph, ≤ 30-pound load</li> <li>Weapon maintenance</li> <li>Manual of Arms</li> <li>Guard duty</li> <li>Marksmanship training</li> <li>Drill and ceremony</li> </ul>	<ul style="list-style-type: none"> <li>Walking loose sand at 2.5 mph, no load</li> <li>Walking hard surface at 3.5 mph, ≤ 40-pound load</li> <li>Calisthenics</li> <li>Patrolling</li> <li>Individual movement techniques; i.e. low crawl, high crawl</li> <li>Defensive position construction</li> </ul>	<ul style="list-style-type: none"> <li>Walking hard surface at 3.5 mph, ≥ 40-pound load</li> <li>Walking loose sand at 2.5 mph with load</li> <li>Field assaults</li> <li>Rifle bayonet training</li> <li>Road march &gt; 4 mph</li> </ul>

Note: Soldiers who are overweight, dieting, or past heat casualties are more prone to heat injuries. As a result, their activities must be closely monitored.